Claims

1. Method of increasing the noise immunity during the reception of signals from the satellites of navigational systems comprising the steps of decoding the signals having a carrier coded with a pseudo-random sequence including generation a local difference (early-minus-late) copy of the input signal in which the delay between the early and late copies of the signal makes up a fractional part of the character of the pseudo-random sequence d, generation of a punctual (exact) copy of an input signal and generation of a sequence of gating digital signals *characterized in that* the gating signal length is set equal to the delay d between the early and late copies of the signal, character polarity is selected so that it coincides with the polarity of previous character of the exact copy and its beginning is delayed relative to the end of the character of the exact copy of the pseudo-random sequence by a value equal to d/2, in so doing there is effected correlation of the input signal comprising, in addition to the direct signal, also a plurality of delayed multipath signals, with the exact copy and with a signal representing a mixture of the difference copy and the sequence of gating digital signals, the correlation results are stored in accumulators and form a discriminator signal for tracing the delay of the code such as $I_{E-L+} I_P + Q_{E-L+} Q_P$, I_{E-L+}, Q_{E-L+} are the in-phase quadrature components of the results of correlation of the input signal with the signal representing a mixture of the difference copy and a sequence of the gating digital signals, I_P, Q_P are the phase quadrature components of the results of correlation of the input signal with the signal of the exact copy, thereby performing the adjustment of the exact and difference copy of the based on the discriminator signal so that error signal influences only the input signal of direct visibility and has no effect on the multipath signals.

2. A method as claimed in claim 1, *characterized in that* the input signal correlation is effected separately for the exact copy of the signal, for the difference copy of the signal and for the sequence of gating digital signals; the correlation results are stored in the corresponding quadrature accumulators, in which case the signal of the discriminator is formed as $I_{E-L} I_P + Q_{E-L} Q_P$,

where I_{E-L}, Q_{E-L} are the in-phase and quadrature components of the results of correlation of the input signal with the difference copy signal, I_P, Q_P are the in-phase and quadrature components of the results of correlation of the input signal with the exact copy signal,

then the value of the accumulators containing the results of correlation of the input signal with the sequence of gating digital signals $I^2 + Q^2$ are compared with the threshold value of detection of the multipath effect and compensate this effect at an excess of the threshold value by adding the output value of the accumulators of gating digital signals to the corresponding quadrature outputs of the difference copy accumulators, producing a discriminator signal in the form:

$$I_{E-L}I_P + Q_{E-L}Q_P + I_P + Q_P.$$

3. Method of increasing the noise immunity during the reception of signals from the satellites of navigational systems consisting in decoding the signals comprising a carrier coded with a pseudo-random sequence including generation a early copy of the input signal, in which the delay between the early and late copies of the signal makes up a fractional part of the character of the pseudo-random sequence d, generation of a sequence of gating digital signals *characterized in that* the gating signal length is set equal to half the delay d between the early and late copy of the signal, character polarity is selected so that it coincides with the polarity of previous character of the exact copy and its beginning is delayed relative to the end of the character of the exact copy of the pseudo-random sequence by a value equal to d/2, in so doing there are effected operations of correlation of the input signal comprising, in addition to the direct signal, a plurality of delayed multipath signals, with the early copy, correlation of the input signal with the signal representing a train of gating digital signals, storage of the correlation results in accumulators and generation of a discriminator signal for tracing the code such as $I_E^2 + Q_E^2 - I_L^2 - Q_L^2 - Q_L^2 + I_K^2$, where I_E, Q_E are the in-phase quadrature components of the results of correlation of the late copy, I_K, Q_K are the in-phase and quadrature components of the results of correlation of the train of gating digital signals.

4. A method as claimed in claim 3, *characterized in that* at the first step, when tracing code delay, the discriminator value is determine as: $I_E^2 + Q_E^2 - I_L^2 - Q_L^2$, while the value of the accumulators storing the correlation results of the input signal with a sequence of gating digital signals $I_K^2 + Q_K^2$ is compared with the threshold value of detection of the multibeam effect, in which case the multibeam effect exceeding

the threshold value is compensated by adding the value from the output of the accumulators to the calculated value of the discriminator so that it becomes equal to $I_E^2 + Q_E^2 - L_E^2 - I_L^2 - Q_L^2 + I_K^2 + Q_K^2$.

5. A device for reception of signals of satellite navigational systems transmitting a plurality of signals with a carrier coded by pseudo-random sequences comprising: a radio module receiving the input signal, converting it into an intermediate-frequency signal including a plurality of signals intermediate frequency carrier coded by the pseudo-random sequence; an analog-to-digital converter, converting the intermediate-frequency signal into a digital signal; a multichannel digital correlator whose each channel decodes one of the plurality of signals coded by pseudo-random sequence, *characterized in that* the device comprises: a generator producing a local punctual (exact) copy of the signal coded by a pseudo-random sequence; a generator producing a difference (early-minus-late) copy of the signal coded by the pseudo-random sequence

in which the delay d between the early and late copies makes a fraction of the pseudo-random sequence character and which generates a sequence of gating digital signals such that the gating signal length is equal to the delay ***d*** between the early and late copies of the signal, the polarity of this character coincides with the polarity of the previous character of the exact copy and its beginning is delayed relative to the end of the character of the exact copy of the pseudo-random sequence by a value equal to d/2; a mixer performing the multiplication (correlation) of the quadrature counts of the input signal by the counts of the exact copy; a mixer performing multiplication of the quadrature counts of the input signal by the counts of the signal, representing a mixture of the difference copy and a sequence of gating digital signals; quadrature accumulators accumulating the correlation results; a device adjusting the delay of the local copy of the signal coded by the pseudo-random sequence depending on the error signal from discriminator output calculated on the basis of the counts of the accumulators as: $I_{E-L+} I_P + Q_{E-L+} Q_P$, where I_{E-L+}, Q_{E-L+} are the in-phase and quadrature components of the results of correlation of the input signal with the signal representing a mixture of the difference copy and the sequence of gating digital signals, I_P, Q_P are the in-phase and quadrature components of the results of correlation of the input signal with the exact copy signal.

6. The device as claimed in claim 5, *characterized in that* each correlator channel comprises: a generator of a local punctual (exact)

copy of the signal coded by a pseudo-random sequence; a generator of a difference (early-minus-late) copy of the signal coded by the pseudo-random sequence, in which the delay ***d*** between the early and late copies makes a fraction of the pseudo-random sequence character; a generator producing a sequence of gating digital signals, such that the gating signal length is equal to the delay ***d*** between the early and late copies of the signal, the polarity of this character coinciding with the polarity of previous character of the exact copy and its beginning being delayed relative to the end of the character of the exact copy of the pseudo-random sequence by a value equal to d/2; a mixer performing the multiplication (correlation) of the quadrature counts of the input signal by the counts of the exact copy; a mixer performing the multiplication of the quadrature components of the input signal by the counts of the difference copy; a mixer performing the multiplication of quadrature counts of the input signal by the counts of the sequence of gating digital signals; quadrature accumulators accumulating the correlation results; a device adjusting the delay of the local copy of the signal coded by the pseudo-random sequence, depending on the error signal from the discriminator output calculated on the basis of the counts of the accumulators as: $I_{E-L}I_P + Q_{E-L}Q_P$, where I_{E-L}, Q_{E-L} are the in-phase and quadrature components of the results of correlation of the input signal with the difference copy signal provided that $I^2 + Q^2$ does not exceed the threshold of detection of the multipath signal, where I, Q are the in-phase and quadrature components of the results of correlation of the sequence of gating digital signals.

7. The device as claimed in claim 5, *characterized in that* each correlator channel comprises: a generator producing a local punctual (exact) copy of the signal coded by the pseudo-random sequence, a generator producing a difference (early-minus-late) copies of the signal coded by the pseudo-random sequence, in which the delay ***d*** between the early and late copies makes up a fraction of the character the pseudo-random sequence; a generator producing a sequence of gating digital signals, such that the gating signal length is equal to the delay ***d*** between the early and late copies of the signal, the polarity of the character coinciding with the polarity of the previous character of the exact copy and its beginning being delayed relative to the end of the character of the exact copy of the pseudo-random sequence by a value equal to d/2; a mixer performing the multiplication (correlation) of the quadrature counts of the input signal by the counts of the exact

copy; a mixer performing the multiplication of the quadrature counts of the input signal by the counts of the difference copy; a mixer performing the multiplication of the quadrature counts of the input signal by the counts of the sequence of gating digital signals; quadrature accumulators accumulating the correlation results; a device adjusting the delay of the local signal copy coded by the pseudo-random sequence depending on the error signal from the output of the discriminator calculated on the basis of the counts of accumulators such as $I_{E-L}I_P + Q_{E-L}Q_P + I_K I_P + Q_K Q_P$ provided that the threshold of detection of the multipath signal is exceeded.

8. The device as claimed in claim 5, *characterized in that* each correlator channel comprises: a generator producing a local early copy of a signal coded by a pseudo-random sequence; a generator producing a late copy of a signal coded by a pseudo-random sequence, in which the delay ***d*** between the early and late copies makes up a fraction of the character the pseudo-random sequence; generator producing a sequence of gating digital signals such that the gating signal length is equal to the delay ***d*** between the early and late copies of the signal, the polarity of this character coinciding with the polarity of previous character of the exact copy and its beginning being delayed relative to the end of the character of the exact copy of the pseudo-random sequence by a value equal to d/2; a mixer performing the multiplication (correlation) of the quadrature counts of the input signal by the counts of an early copy; a mixer performing the multiplication of the quadrature counts of the input signal by the counts of the late copy; a mixer performing the multiplication of the quadrature counts of the input signal by the counts of the sequence of gating digital signals; quadrature accumulators accumulating the correlation results; a device adjusting the delay of the local signal copy, coded by the pseudo-random sequence, depending on the error signal from the discriminator output calculated on the basis of the counts of the accumulators as: $I_E^2 + Q_E^2 - I_L^2 - Q_L^2 + I_K^2 + + Q_K^2$, where I_E, Q_E are the in-phase and quadrature components of the results of correlation of the early copy, I_P, Q_P are in-phase and quadrature components of the results of correlation of the late copy, I_K, Q_K are the in-phase and quadrature components of the results of correlation of the sequence of gating digital signals.

9. The device as claimed in claim 5, *characterized in that* the discriminator signal for the device tracing the code delay is determined as $I_E^2 + Q_E^2 - I_L^2 - Q_L^2$, the value of the accumulators

storing the results of correlation of the input signal with the sequence of gating digital signals I2 + Q2, the detected multibeam effect is compared with the threshold value and, if this effect exceeds the threshold value, the output values of the accumulators are added to the calculated discriminator value so that it becomes equal to $I_E{}^2 + Q_E{}^2 - I_L{}^2 - Q_L{}^2 + I^2 + Q^2$.